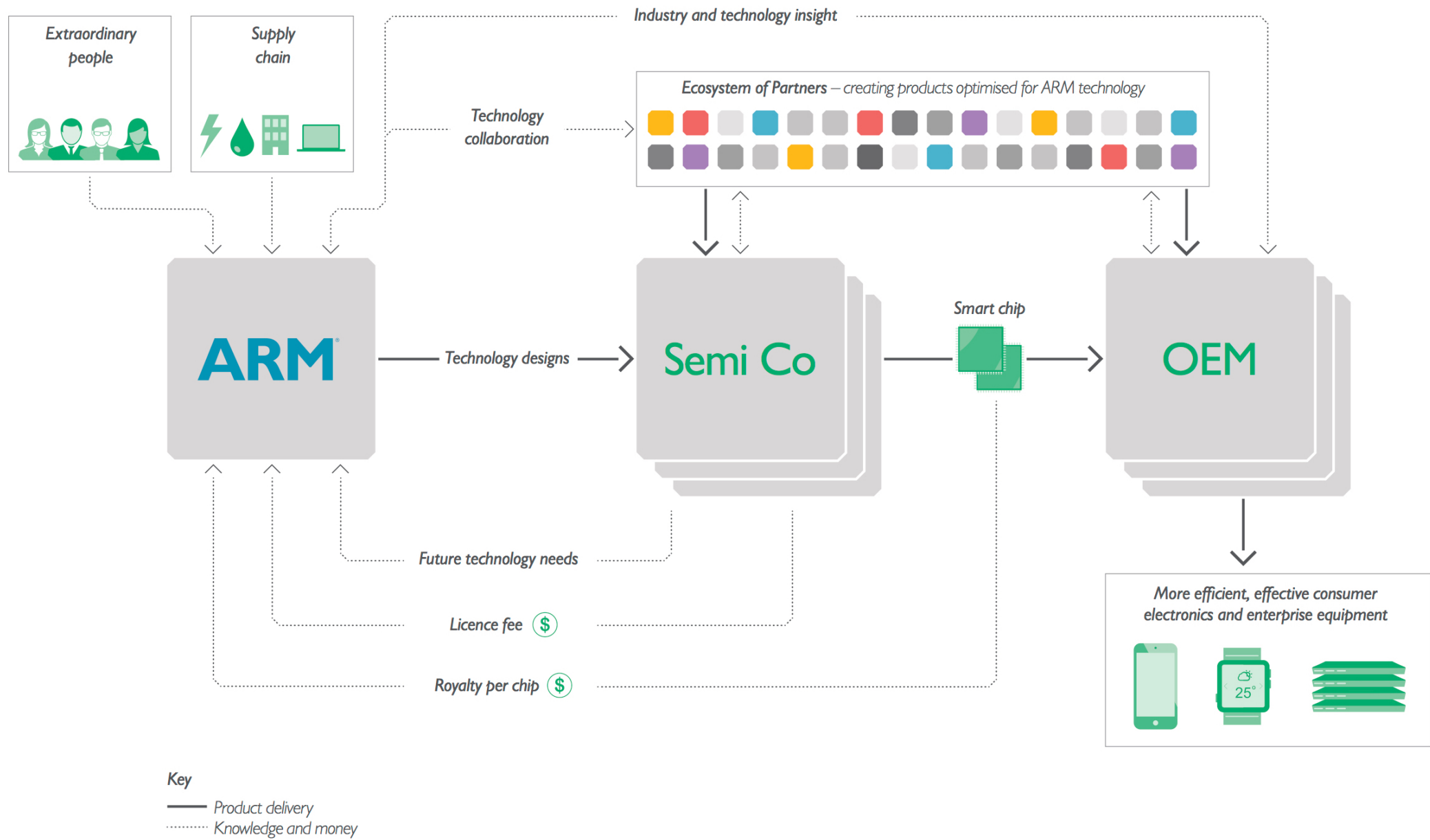


Current trends for hardware and software developers

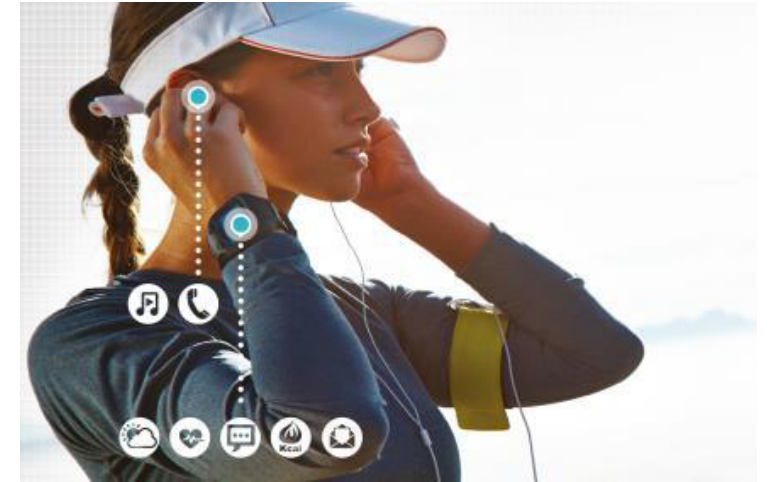
Vrajesh Bhavsar
IoT Segment Marketing Manager

 @vrajeshio

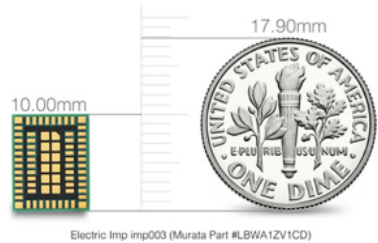


12 Billion

ARM based chips shipped in 2014 by
leading semiconductor companies

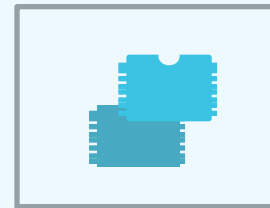


Everything Connected

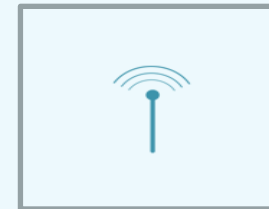


4 Billion

ARM Cortex-M chips shipped in 2014
by leading semiconductor companies



MCUs



radios

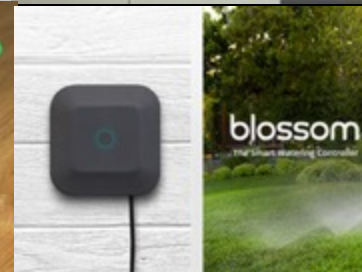
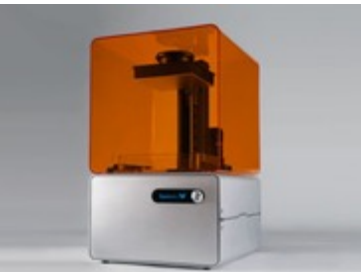
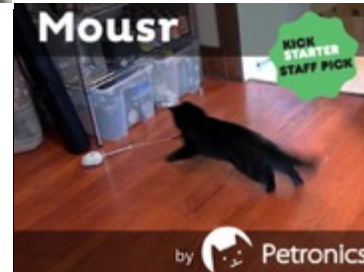
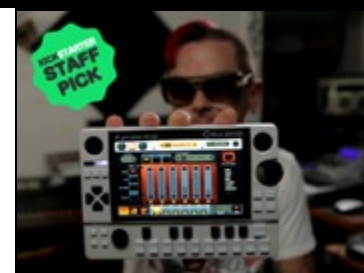


sensors



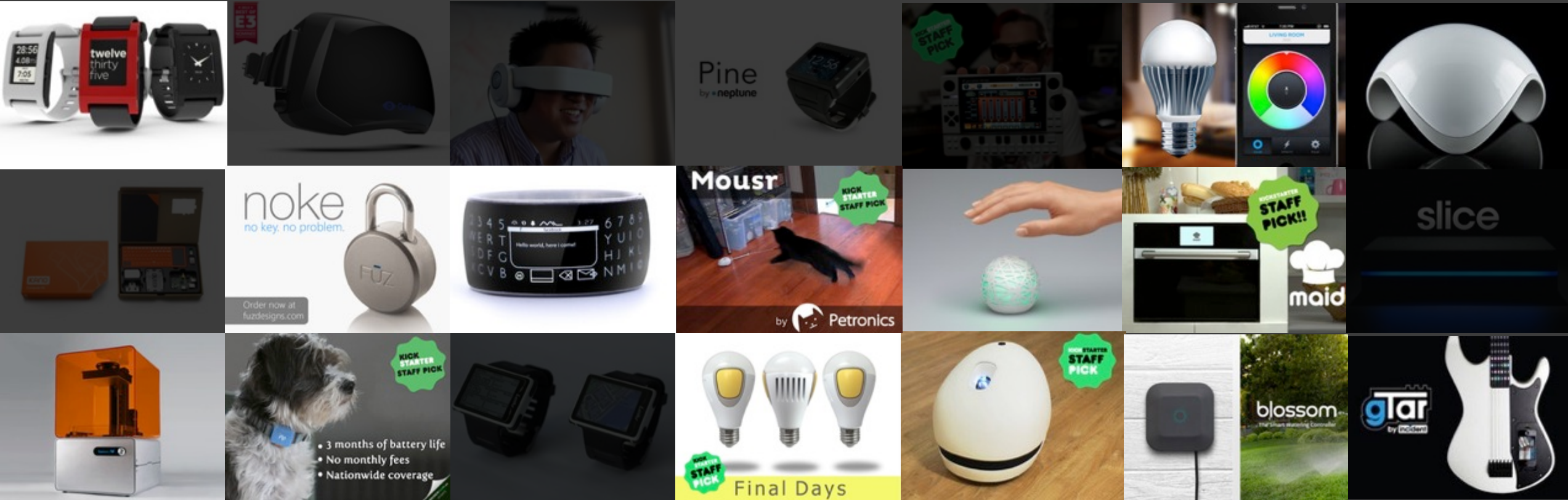
www.kickstarter.com/arm

KICKSTARTER

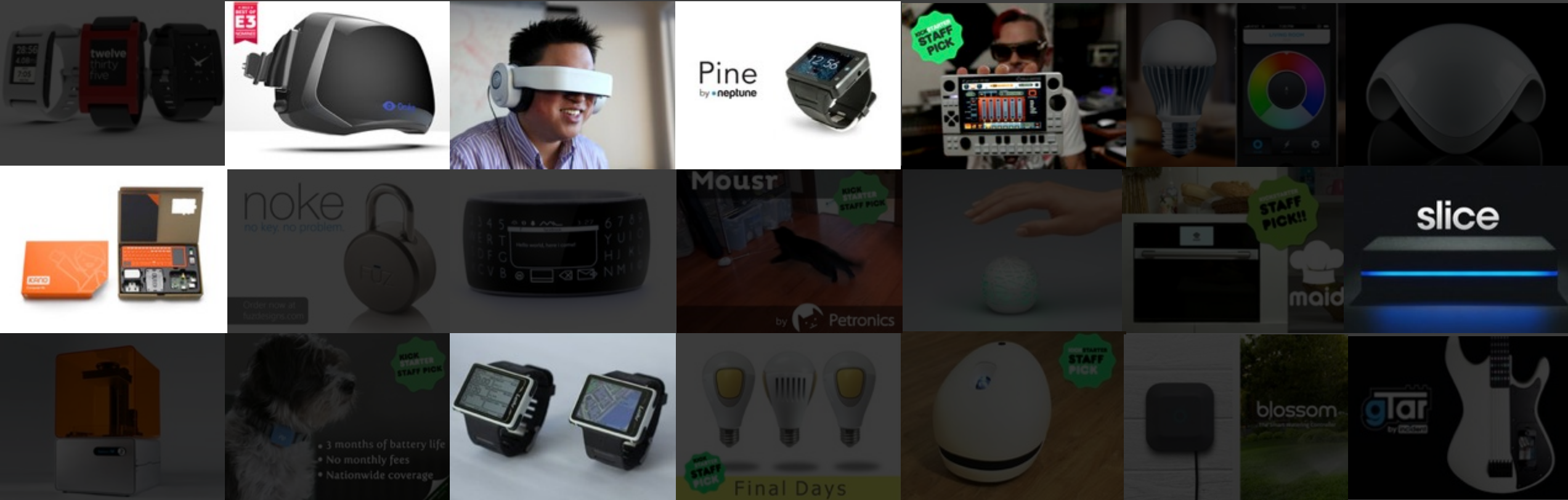


ARM

Wide innovation today on Cortex-M

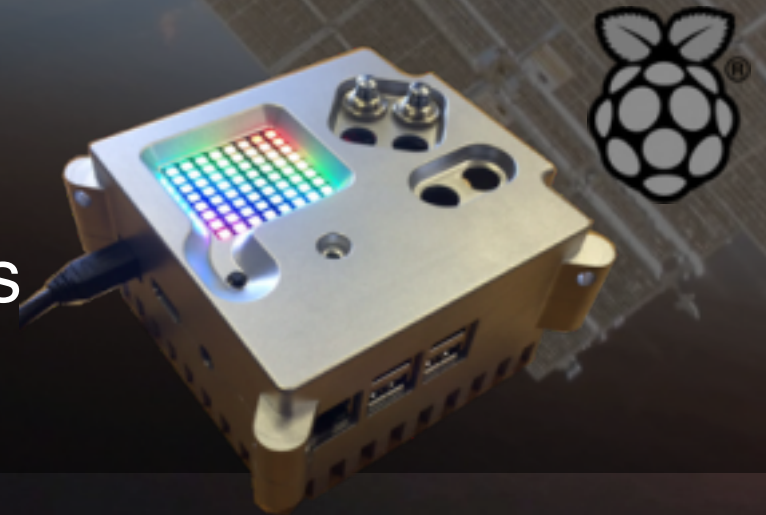


Richer experiences on Cortex-A

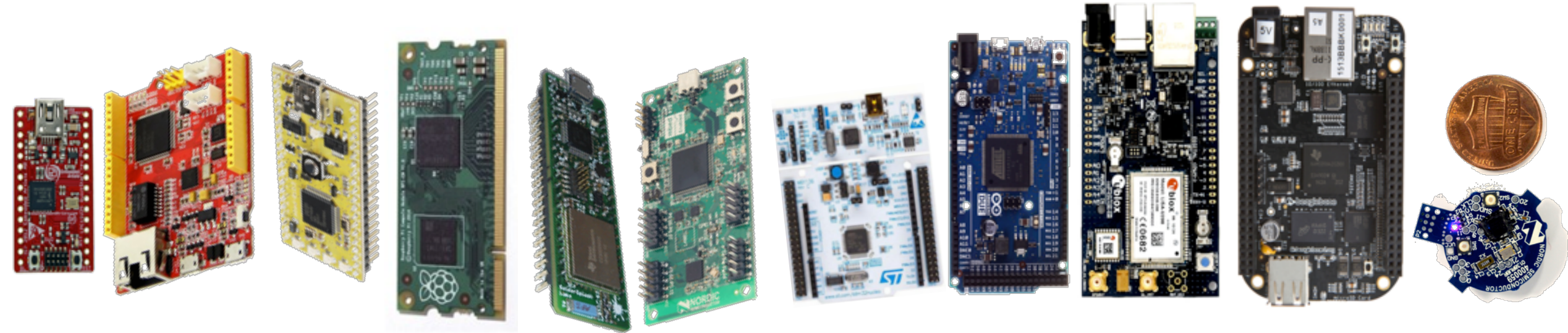


Democratizing technology

- Raspberry Pi based “Astro Pi” project
- School children’s experiments to run in space
- Astronaut Tim Peake & UK space organizations
- Joins international Space Station (ISS) in 2016



Choice



“Internet of Things”



IoT Evolution in your business

Monitoring

- 1 Sensors and external data sources enable the comprehensive monitoring of:
 - the product's condition
 - the external environment
 - the product's operation and usageMonitoring also enables alerts and notifications of changes

Control

- 2 Software embedded in the product or in the product cloud enables:
 - Control of product functions
 - Personalization of the user experience

Optimization

- 3 Monitoring and control capabilities enable algorithms that optimize product operation and use in order to:
 - Enhance product performance
 - Allow predictive diagnostics, service, and repair

Autonomy

- 4 Combining monitoring, control, and optimization allows:
 - Autonomous product operation
 - Self-coordination of operation with other products and systems
 - Autonomous product enhancement and personalization
 - Self-diagnosis and service

[Source: HBR]

Hardware trends

Expanding the Connected Experience

Doing More With Your Smartphone



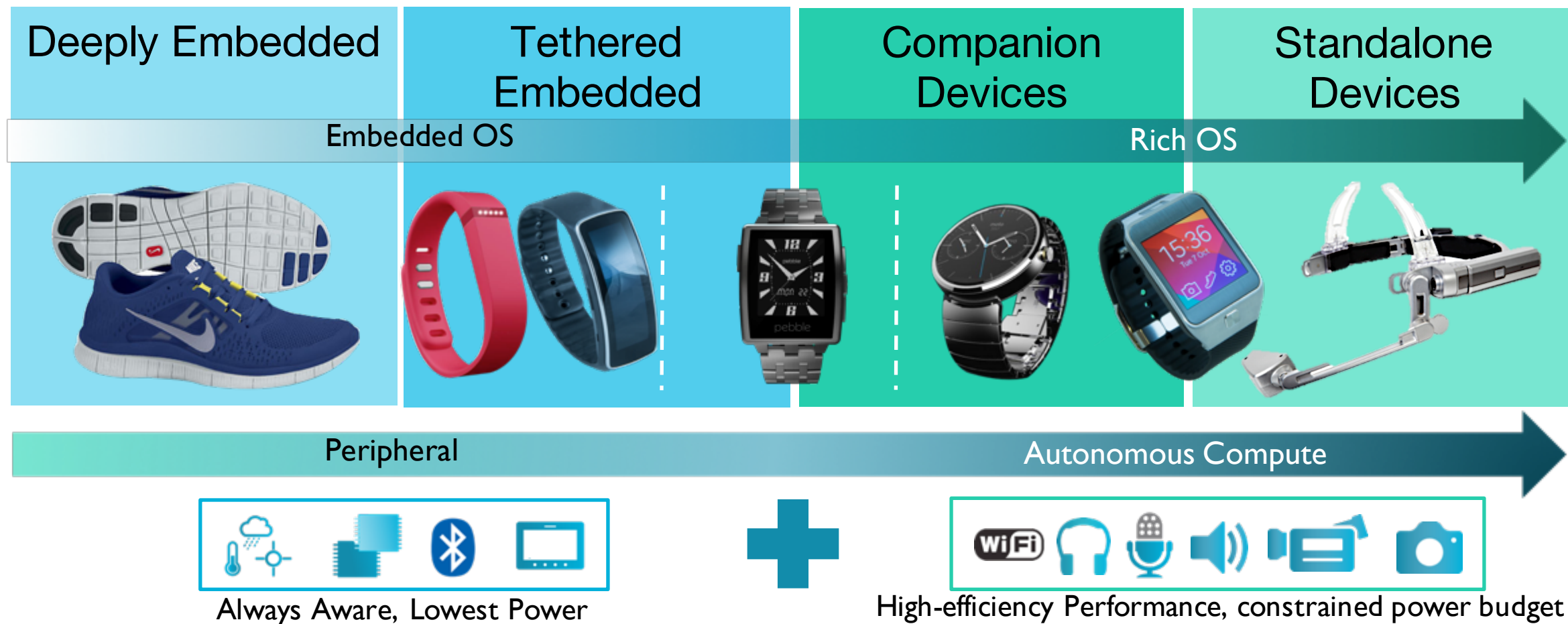
Expanding the Connected Experience

Improving Your Lifestyle Through Smart “Appcessories”



Wearable Market

Wearables



Expanding the Connected Experience

Enhancing Life With a Smarter Home

Communications

- Broadband modem
- Wireless router
- Home data gateway
- VOIP gateway
- VOIP phone

Home entertainment

- Smart TV
- Set top box
- Wireless speakers
- Blu-Ray/DVD player
- Streaming media player
- Digital cameras
- Digital picture frames

Appliances

- Refrigerator
- Clothes washer
- Clothes dryer
- Cooktop/oven
- Dishwasher
- HVAC
- Water heater
- Vacuum cleaners

Safety and security

- Security system
- Camera surveillance
- Smoke detectors
- CO detectors
- Motion detectors
- Door and window sensors

Convenience

- Door locks
- Windows and blinds
- Lighting
- Smart energy meter
- Thermostat
- Power outlets
- Vacuum cleaner
- Irrigation sensing and control



Smart, Connected Hardware Driving Innovation in Home

Expanding possibilities of hardware accelerating the smart home

50 ARM-based chips in
average smart home in 2020*



*ARM estimates

ARM

Expanding the Connected Experience

Making Your Car Do More For You

Vehicle systems

- Engine control
- Throttle control
- Transmission control
- Adaptive suspension
- Active steering
- Anti-lock braking
- Battery management
- Passenger airbags
- Tire pressure monitoring
- Immobilizer and alarms
- Telematics
- Communication gateway



Driver cockpit

- Instrument cluster
- Heads-up display
- Infotainment
- Drowsy driver detection
- Audio control
- Climate control

Advanced driver assistance

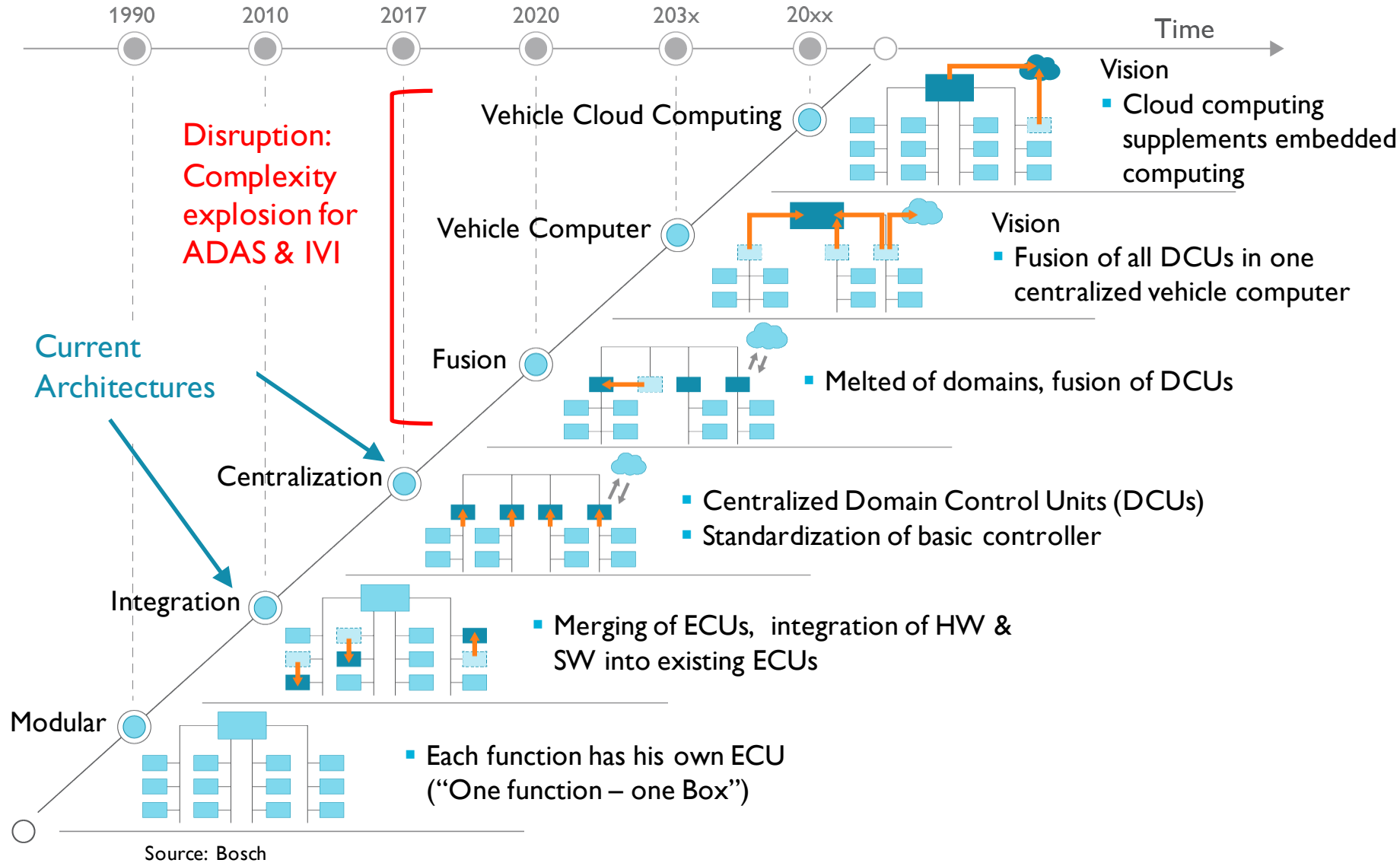
- Back up camera
- Blind spot detection
- 360 surround view
- Automatic parking
- Automatic braking
- Lane keeping
- Pedestrian and sign recognition

Convenience features

- Keyless entry and remote start
- Mirror control
- Power windows
- Seat comfort and adjustment
- Motorized trunks lift gates
- Interior lighting
- Rear seat entertainment
- Wipers



Automotive Architectures



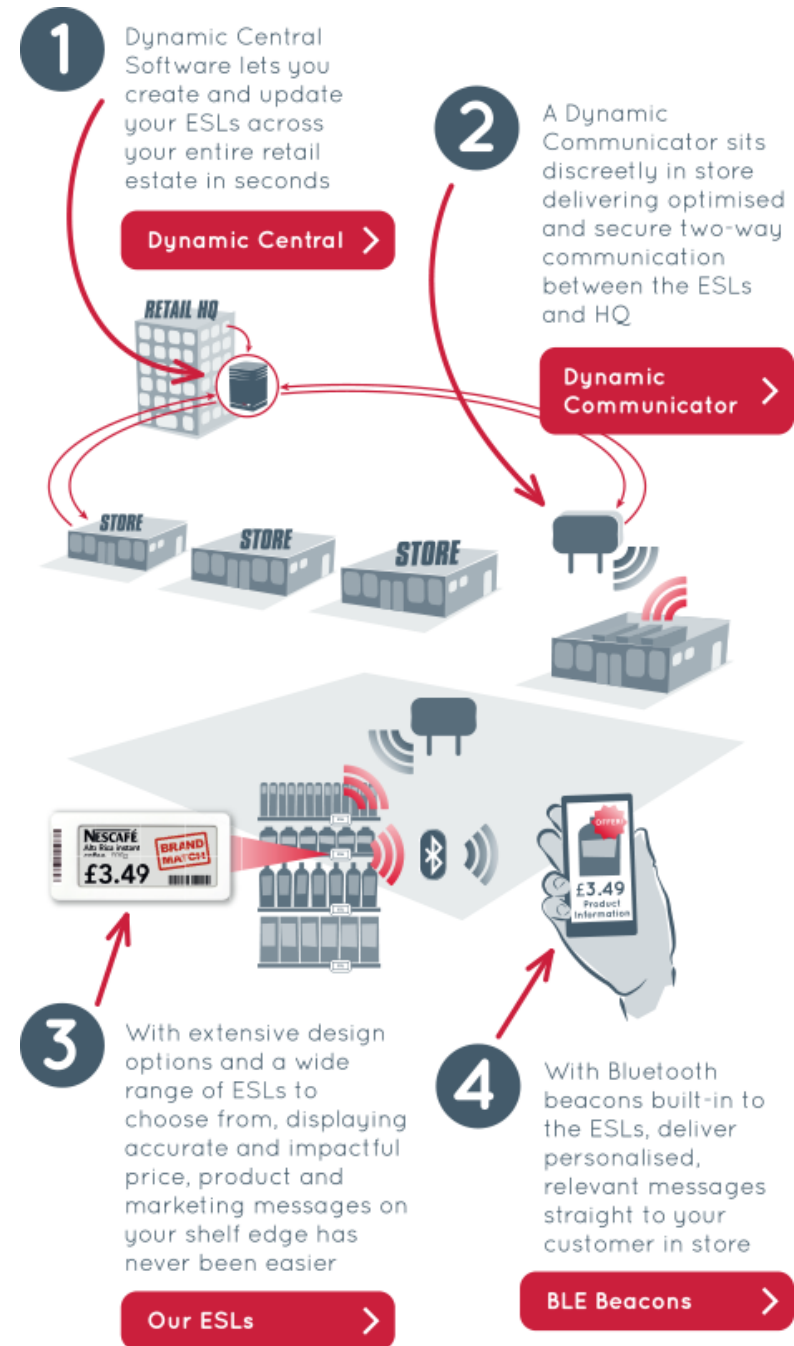
- NHTSA mandates rear camera for 2018 and is considering mandate for V2V and V2I by 2017
- Nissan CEO, Carlos Ghosn vows to have fully driverless car on sale by 2020
- Self driving technology is a priority for automakers
- This disruption is creating demand for complex SoC

ARM Ecosystem is Driving Automotive Technology Leadership

- **Vehicle Sensor Fusion** (vehicle context to environment)
 - Analyzing the multitudes of sensor data: Camera, Radar, Ultrasonic, GPS, V2V, and V2I.
 - Similar to sensor hubs in mobile devices creating “contextual awareness”
 - Key building block to robust, fail-functional, autonomous driving
- **Passenger Contextual Awareness** (occupant context to vehicle)
 - Vehicle that anticipates your needs by listening and seeing
 - always-on voice-recognition
 - Interior camera = “the eyes of the car”
 - Facial / occupant recognition to optimize the vehicle to your likes.
- **Advanced Gateway “heart of the car”**
 - Gateway is at the “heart” of the vehicles enabling distribution of information.
 - “Data” like “life blood” moves from module to module enabling both embedded and cloud computing.
 - Gateway is central to providing FOTA software updates that will allow carmakers to upgrade software in the field just as smartphones get OS updates.



Retail - Smart displays/tags



Location - Beacons



Great APIs for developers



Great radio performance

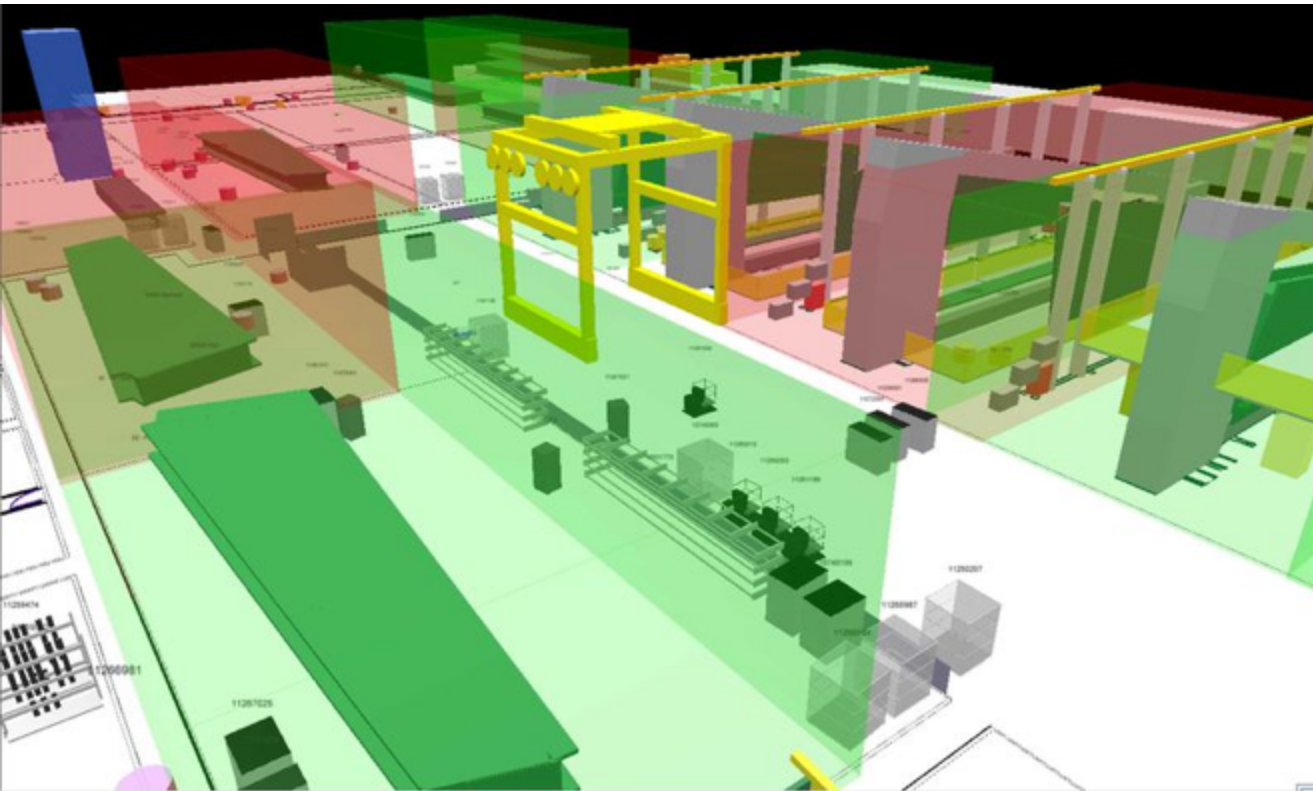


Deep user understanding

Hospitality & Entertainment



Factory of the Future



Source: Airbus / National Instruments



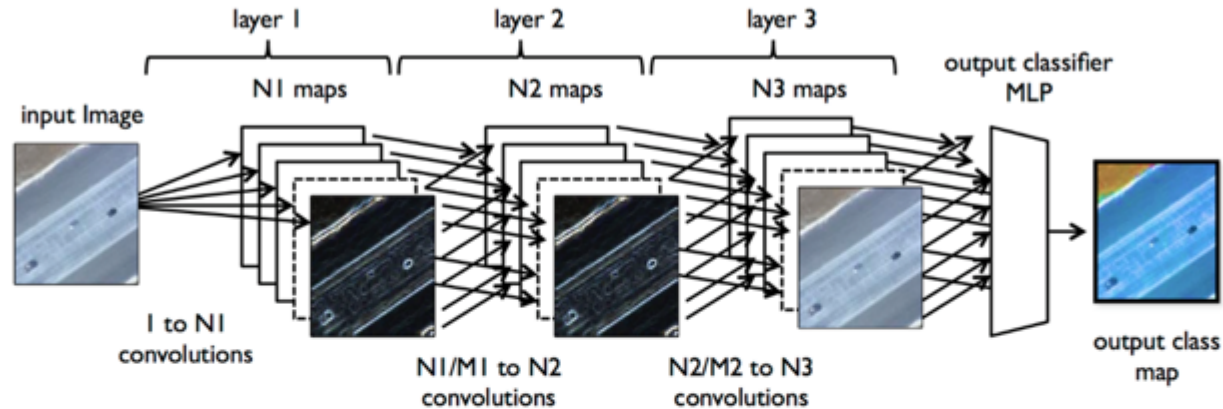
Airbus has incorporated innovative digital tracking and monitoring RFID technology to help streamline and increase the efficiency of its industrial operations.

Airbus can track and visualize its production processes in real-time.

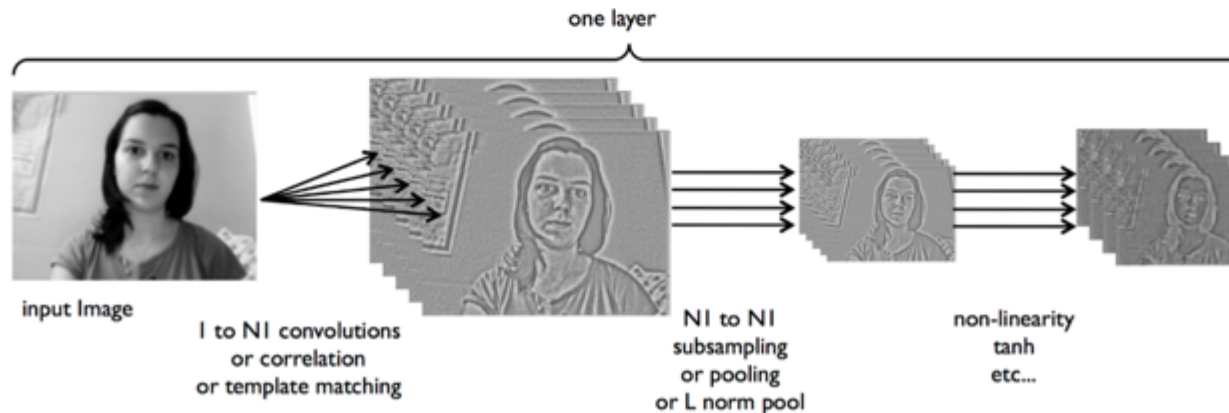
RFID component tracking and machine vision systems using National Instruments / Cortex-A based SBCs

Software algorithms in hardware – eg. Teradeep

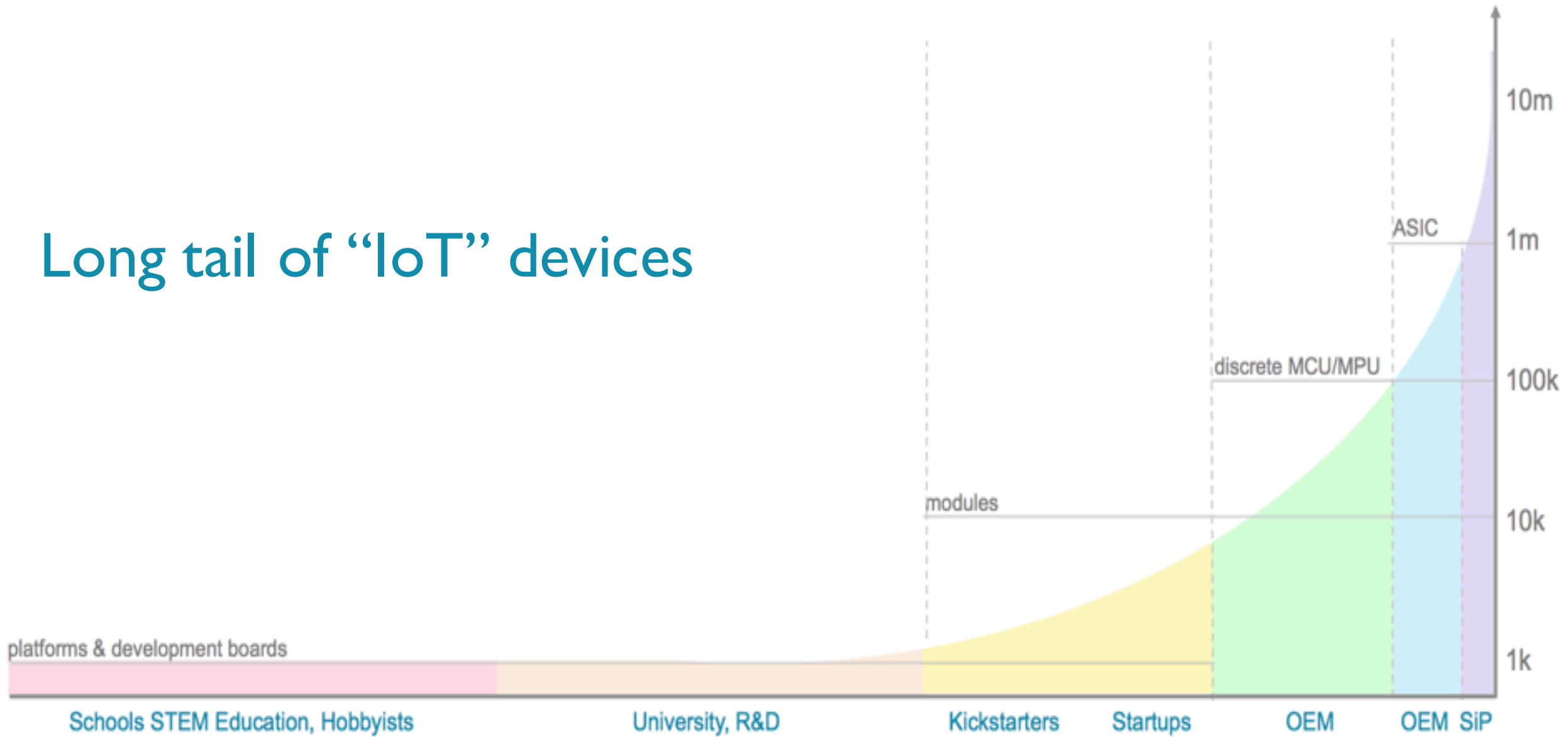
We use the latest machine-learning algorithms with efficient implementation in software and hardware. Our main scientific tool are multi-layered neural networks.



These network are composed of multiple layers of processing. Each layer performs: feature extraction with filter templates, reduction of input resolution, non-linear operations



Long tail of “IoT” devices





Hardware platforms – the new gold rush



Software trends

Security

[Source: bankinfosecurity.com]

Target Corp.
110 MILLION
People affected
Information compromised:
Credit and debit cards, customer details



Home Depot
56 MILLION
People affected
Information compromised:
Credit and debit card numbers



Michaels
3 MILLION
People affected
Information compromised:
Payment card numbers, expiration dates



Neiman Marcus
350,000
People affected
Information compromised:
Credit and debit cards



- Security hacks are having corporate wide impact & is discussed all the way in board meetings
- While enterprises try to secure their current assets, they're vary about adding “new threats”
- IoT solutions need to address these concerns about network security as well as customer privacy

The era of the platforms...

1990s

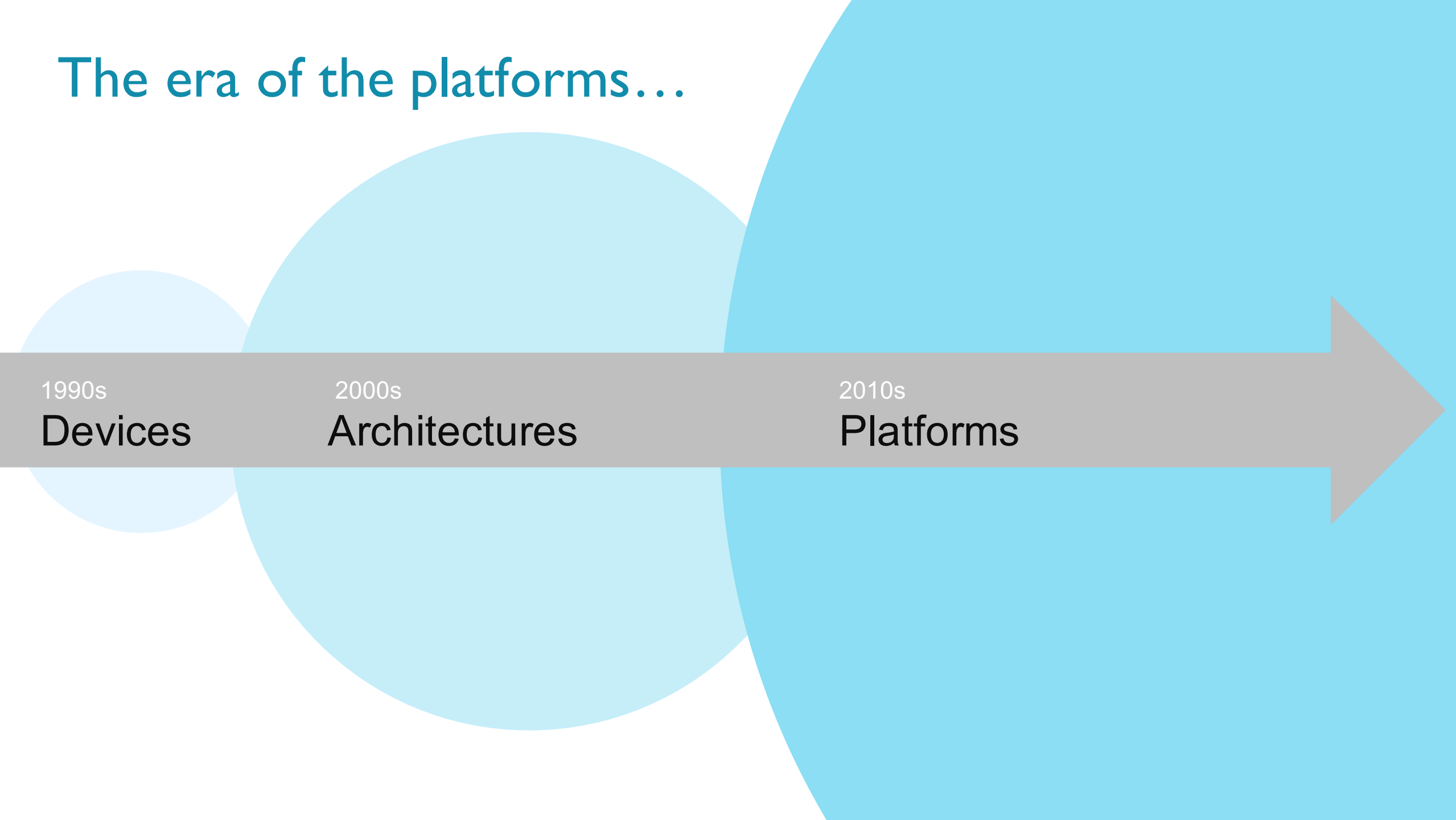
Devices

2000s

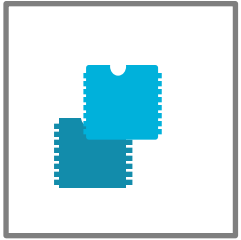
Architectures

2010s

Platforms



Software



MCU/MPUs



radios



sensors

C / C++



yocto
PROJECT



ARM

Celebrating 5 years of Open Source Engineering on ARM

Linaro

24TB



data from June 2014 - May 2015
615,000 downloads from >100 countries



16 Connects

14 Cities on 3 continents



32 member companies

Six members at launch



4,410

gallons consumed at Linaro Connects

1,141,014

minutes of videos showing demos, talks and training sessions watched

More than



220 Engineers

from seed of twenty



company contributor for
Linux Kernels 3.11 - 3.18

11,589

patches upstream since 2011



~20
hardware
platforms

www.linaro.org
www.96boards.org

"The ARM situation has just improved tremendously over the last several years. It used to be a major pain to me, it has gone to almost being entirely painless."



- Linus Torvalds
May 2015



50,217

Wiki pages



>1 Million

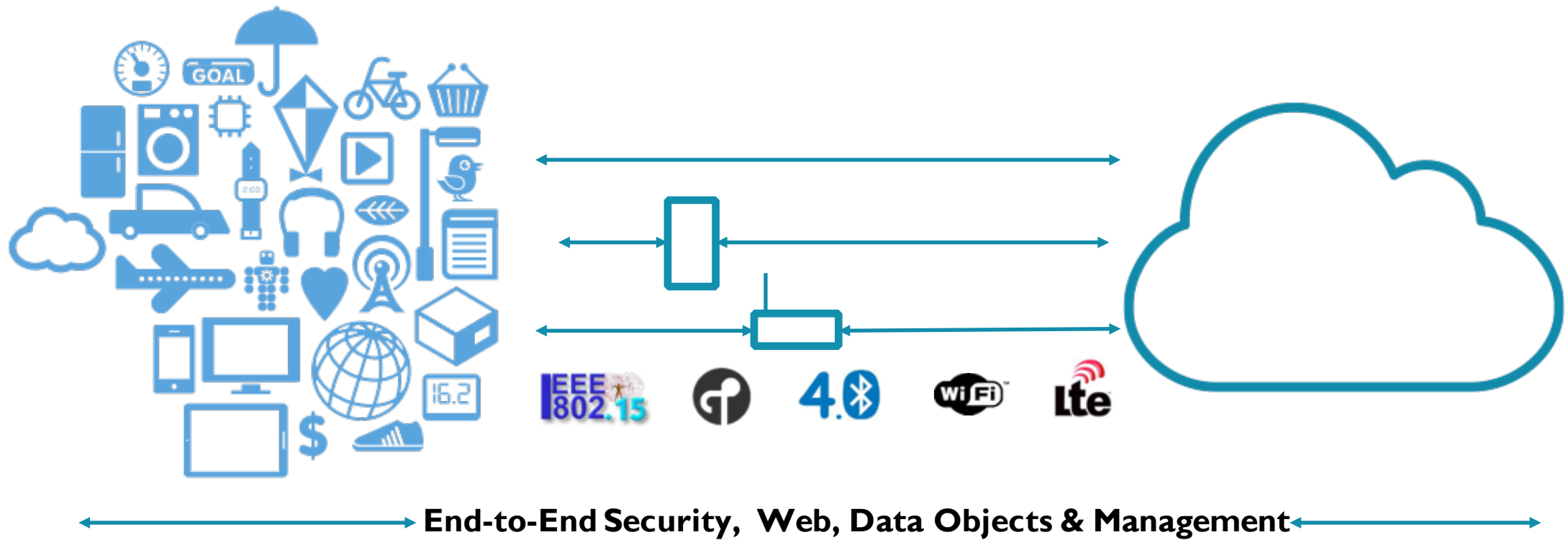
website users



Note:
Linus Torvalds Image from Linux Foundation. Icons made by Freepik. Logos & trademarks remain the property of their respective owners and represent a range of products and services supported by Linaro.

ARM

Getting “things” online...



Little Data

BIG DATA

ARM[®]mbed[™]

IoT Device Platform

ARM

mbed Ecosystem

- Partners
- Developers
- Enabled Services
- Enabled Products

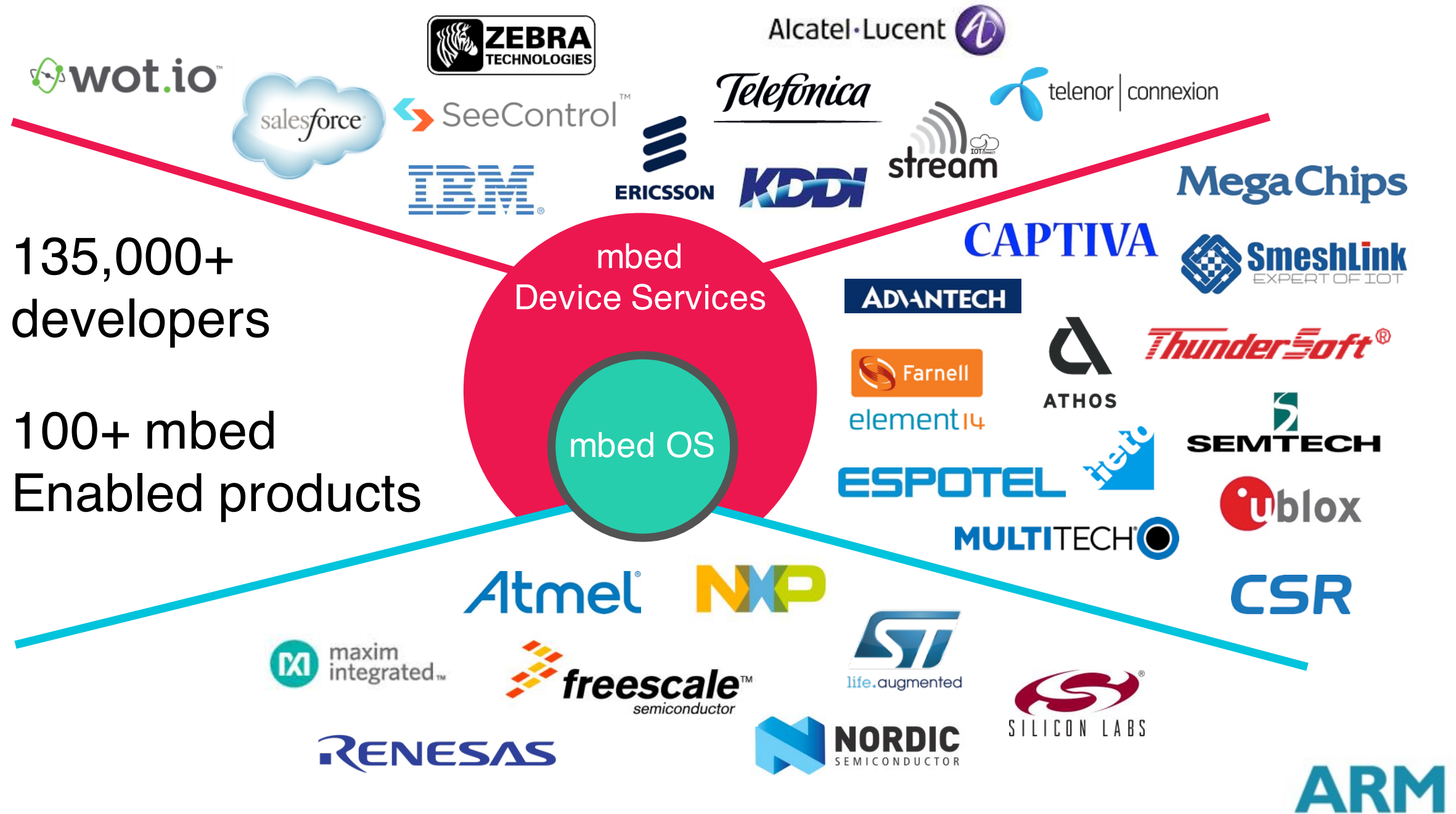
mbed Device Server

Free and commercial versions
Application data and device management
Growth market access for cloud platforms
and operators

mbed OS

Free & open source for ARM
Leading connectivity standards
Productivity, minimized costs
Built-in device management
Security

ARM Cortex[®]-M
-based MCU

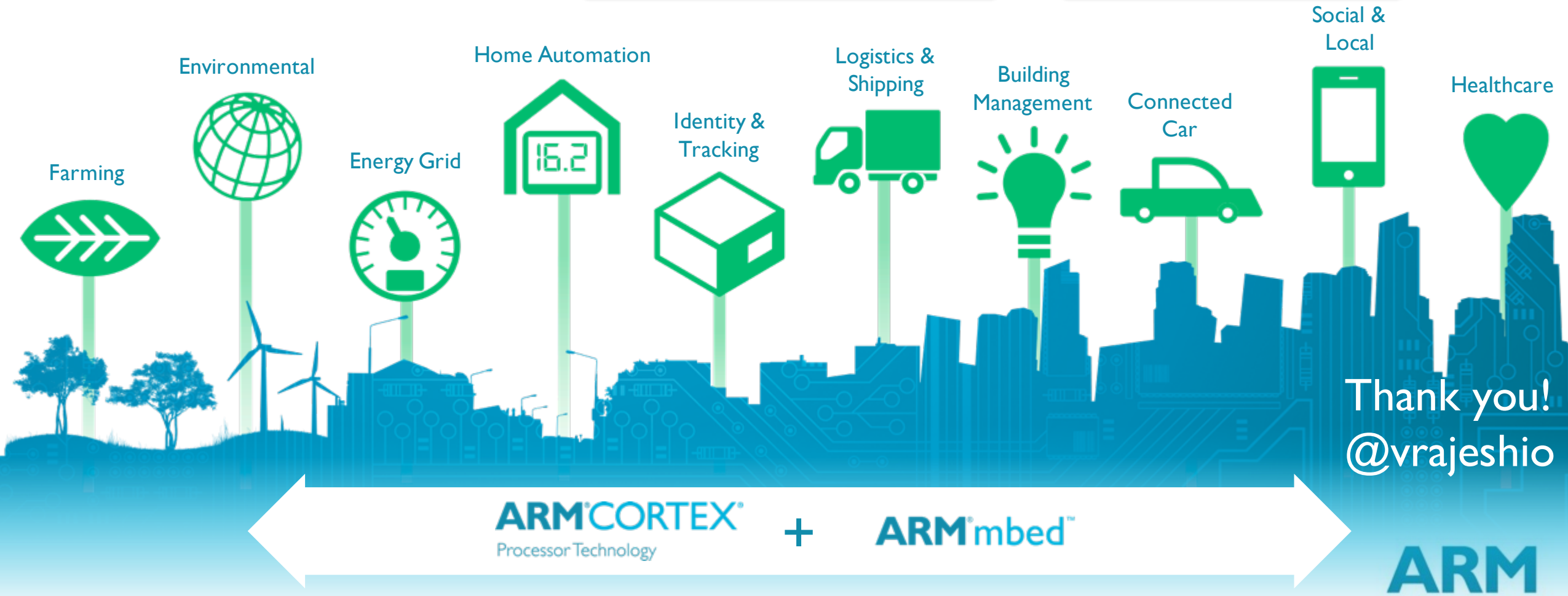


Anything that could be connected, will be...

Right-size processing
for new markets

Delivering more performance
with less power

Delivering the time and
innovation advantage



Thank you!
@vrajeshio